Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Binder \_\_\_\_\_\_\_\_\_

**Fill in the Blank Notes - #1-5**

1. **Astronomy** – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. **Geocentric** – E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is at the center of the U\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_;

 Sun, P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, Moon, S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rotate around the Earth

 \*Stars rotate on the O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a hollow S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \*\_\_\_\_\_\_\_\_\_ wanderers inside the sphere: Sun, M\_\_\_\_\_\_\_\_\_\_\_\_\_\_, Mercury, V\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

 Mars, J\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, Saturn

3. Geocentric View – Ancient Greeks

 **Aristotle** believed this.

 **Erotosthenes** – around 2000 BC

 \*Calculated the S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ within \_\_\_\_\_\_% of true size

4. Geocentric View – Ancient Greeks

 **Ptolemy** – AD 141

 \*Created theory of E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to explain Retrograde M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \*C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ adopted Ptolemaic Astronomy

5. **Retrograde Motion**

 Def – The apparent W\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ motion of P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with respect to

 S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Planets seemed to M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ B\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ at times

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Binder \_\_\_\_\_\_\_\_\_

**Fill in the Blank Notes - #6-9**

6. **Heliocentric – Copernicus**

 C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1473-1543) proposed H\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ view

 \*Believed the Earth R\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \*Believed in C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ orbits (N\_\_\_\_\_\_\_\_\_\_\_\_ T\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

 \*Catholic Church considered him a H\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. **Heliocentric**

 Def – E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, moon, P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ else orbit

 The sun

 \*Is this True? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. **Revolution**

 Def – M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a B\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ along a P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 around some P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 **Draw:**

 \*Earth R\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ around the S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 It takes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the earth to revolve around the sun.

 \*M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ revolves around the E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 It takes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the moon to revolve around the Earth.

9. **Rotation**

 Def – the T\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ / S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a body on it’s A\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 **Draw:**

 Earth rotates on it’s axis 1 time in \_\_\_\_\_\_\_\_\_\_\_\_ hours (creating our D\_\_\_\_\_\_\_\_ / N\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Binder \_\_\_\_\_\_\_\_\_

**Fill in the Blank Notes - #10-12**

10. **Heliocentric – Tycho Brahe (1564-1601)**

-Extremely A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of stars and P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 -Rejected Copernican (Heliocentric) View and came up with his own theory

 -Detected S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,

 **Draw:**

11. **Stellar Parallax**

 Def-The Apparent slight S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in basic P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of S\_\_\_\_\_\_\_\_\_\_\_\_\_

 due to the E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 \*The most basic way to measure stars

 -very small angles (1/3600 of a degree)

 \*Only useful with C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(only about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ total)

12. Distance to the Stars – example

 Demonstration – thumb, right and left eyes

12. Parallax Problems

 **1 parsec = 3.26 light years**

1. What is the parallax (0) of a star located 10 parsecs away?

Answer: R = 1 10 = 1 X = 1 X = 0.1 or 0.1”

 0 X 10

 2. What is the distance of a star with a parallax of 0.04”?

 Answer: R = 1 R = 1 R = 25 parsecs

1. 0.04

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Binder \_\_\_\_\_\_\_\_\_

**Fill in the Blank Notes - #13-18**

13. **Johannes Kepler** – Heliocentric (1571-1630)

 -Tycho Brahe’s assistant. Used Brahe’s M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and D\_\_\_\_\_\_\_.

 -Created the \_\_\_\_\_\_ Laws of P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- Motion

14. **3 Laws of Planetary Motion**

 -1st Law – Law of E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 -2nd Law – Equal T\_\_\_\_\_\_\_\_\_\_\_\_\_\_, E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Area

 -3rd Law – H\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Law (D\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ relates to T\_\_\_\_\_\_\_\_\_.)

15. **1st Law: Law of Ellipses**

 -Def – P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ travel in E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ orbits with the S\_\_\_\_\_\_\_ at one F\_\_\_\_\_\_\_\_\_\_\_\_\_.

 -**Eccentricity** = Distance **between F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (A)**

 Distance from \_\_\_\_ S\_\_\_\_\_\_\_\_\_\_ to O\_\_\_\_\_\_\_\_\_\_\_\_ **(B)**

 **-**Drawing of eccentricity …………………………………………………………………….

16. **2nd Law: Equal Area in Equal Time**

 **-**Def – Planets S\_\_\_\_\_\_\_\_\_\_\_\_\_\_ through E\_\_\_\_\_\_\_\_\_\_\_\_ areas in Equal T\_\_\_\_\_\_\_\_\_\_\_.

 -Planets are F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the S\_\_\_\_\_\_\_\_\_\_.

 **Draw:**

17. **3rd Law: Harmonic Law**

 -Def: The F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the Planet is from the S\_\_\_\_\_\_\_\_\_\_, the L\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it takes to

 O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the S\_\_\_\_\_\_\_\_\_\_\_.

 Formula: P2 = A3  P = P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of Orbit (Y\_\_\_\_\_\_\_\_\_\_\_\_\_), A = D\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (AU)

18. **Astronomical Unit (AU)**

 -Def: A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ D\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between the E\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and S\_\_\_\_\_\_\_\_.

 Draw:

 1 AU is about \_\_\_\_\_\_\_ million km or about 93 million miles

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Binder \_\_\_\_\_\_\_\_\_

**Fill in the Blank Notes - #19-24**

19. Heliocentric - **Galileo Galilei (1564-1642)**

 **-**First to use S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to support his theories

 -Built his own T\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from scratch

 -C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ gave L\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ sentence for his views.

 -Went B\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from looking at the S\_\_\_\_\_\_\_\_\_\_\_\_\_

20. **Galileo’s 1st discovery**

- \_\_\_\_\_\_\_\_\_ moons of J\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 -Ganymede, C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, Io, E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

21. **Galileo’s 2nd Discovery**

 -P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ discs, not just P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of L\_\_\_\_\_\_\_\_\_\_\_.

22**. Galileo’s 3rd Discovery**

 -v\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, just like the M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

23. **Galileo’s 4th Discovery**

 -The M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ surface is N\_\_\_\_\_\_\_\_\_ S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

24. **Galileo’s 5th Discovery**

 -The S\_\_\_\_\_\_\_\_\_\_\_\_\_\_ has D\_\_\_\_\_\_\_\_\_\_ R\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ called S\_\_\_\_\_\_\_\_\_\_\_ S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Binder \_\_\_\_\_\_\_\_\_

**Fill in the Blank Notes - #25-34**

25. **Sir Isaac Newton** (1642-1727)

 -known as the “G\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ scientist of A\_\_\_\_\_\_\_\_\_\_ T\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 -Inventor of C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and Classical P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 -Formulated the Law of G\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 -Discovered that W\_\_\_\_\_\_\_\_\_\_\_ Light can be broken into R\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 -Invented the R\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ T\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 -Went B\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from looking at the S\_\_\_\_\_\_\_\_\_.

26. **Newton’s First Law – Inertia**

-A B\_\_\_\_\_\_\_\_\_\_\_\_ remains at R\_\_\_\_\_\_\_\_\_ or in M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with a constant V\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 unless acted upon by an O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 -If you T\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a ball in S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, it keeps going on F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 -Why does an A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fall out a T\_\_\_\_\_\_\_\_\_\_\_? Wasn’t it at R\_\_\_\_\_\_\_\_\_\_\_\_\_ in the tree?

27. **Gravity**

 Def: The F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that attracts a B\_\_\_\_\_\_\_\_\_\_ toward the C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the earth,

 S\_\_\_\_\_\_\_, or toward any other P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ body having M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

28. **Inertia**

 Def: E\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ body continues its S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of Motion or R\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (and

 V\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) in the A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of an O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ force.

29. **Why do planets stay in orbit?**

 -Gravity and Inertia work together

 **Draw….**

30**. Universal Gravitation**

 Def: All O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the U\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ attract each other

 -Gravity is P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to their M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Larger

 M\_\_\_\_\_\_\_\_\_\_, larger f\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of Attraction.)

 -Inversely proportional to the S\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the D\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 1 km apart = **1**, 3 km apart = **32**, or \_\_\_\_ times less F\_\_\_\_\_\_\_\_\_\_\_

 Closer and L\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the objects are, the G\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the force of G\_\_\_\_\_\_\_\_\_\_\_.

31. **Universal Gravitational Formula**

 -Every body A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ every O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 -Formula – Copy this down…

 **F** = F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of G\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (N – Newtons)

 **m1** = Mass of the F\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ object (kg)

 **m2** = M\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the Second O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (kg)

 **G** = Gravitational C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 **D** = D\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ between O\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (m)

32. **Universal Gravitation Calculations - Example**

What is the gravitational force between a **100 kg** mass and a **30 kg** mass separated by **2 m**? F = G x \_ kg x kg

 22

* F = G \* 3000 F = \_\_\_\_\_\_\_\_\_\_\_ G

 4

33. **Precession**

 Def: the A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ T\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ changes over T\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Today, the N\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ P\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ faces the North S\_\_\_\_\_\_\_\_\_\_\_ (Polaris)

 In many years from now, it will face the star V\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

34. **Why do we have seasons?**

 **-**Earth is tilted at \_\_\_\_\_\_\_\_\_ degrees

 -March 21 and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: Sun is D\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ overhead (\_\_\_\_\_\_\_/night equal)

 -\_\_\_\_\_\_\_\_\_\_ 21: Sun above N\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ H\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (L\_\_\_\_\_\_\_\_\_\_\_\_ days = W\_\_\_\_\_\_\_\_\_\_\_)

 -December \_\_\_\_: S\_\_\_\_\_\_\_\_ above Southern H\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Shorter D\_\_\_\_\_\_\_\_\_ = C\_\_\_\_\_\_\_\_\_\_\_)

 **Draw:**